

## STUDY OF BLOOD PRESSURE PROFILE IN SCHOOL

### CHILDREN IN BANGALORE CITY

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#### ABSTRACT

##### Introduction

*Hypertension is one of the major killer diseases causing death annually in the world. The prevalence of hypertension among Indian adolescents has been reported to range from 2-9%.*

##### Aim of the study

*The present study was done in school children to know the prevalence of hypertension and to study the relation of hypertension with age, sex, height, weight, BMI, family history and socio economic status.*

##### Subjects and methods

*It is an observational study done in randomly selected government and private school children in the age group of 6-15 years. The study sample included apparently healthy asymptomatic 1449 children. For each child height, weight, BMI was calculated and three blood pressure recordings were done and the mean of the three recordings was taken. Any family history of hypertension of the children was also taken.*

##### Results

*The prevalence of hypertension in this study was found to be 4.69% which was 2.55% in boys and 2.14% in girls*

##### Conclusion

*Present study concludes that blood pressure could be associated with age and BMI. It was not significant in children with family history of hypertension and in different classes of socio economic status.*

**KEYWORDS:** Prevalence, Hypertension, Socio Economic Status

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## INTRODUCTION

Hypertension is one of the major killer diseases causing death annually in the world. The prevalence of hypertension among Indian adolescents has been reported to range from 2- 9%.Majority is of the essential type. In the past decade, many studies have confirmed that familial aggregation of blood pressure occurs among adults which has been traced to childhood, as early as one year of age and there is some evidence to believe that such an aggregation begins somewhere between first week and first month of life<sup>1</sup>. Children with upper percentile of blood pressure levels are more likely to become adult hypertensive. If the trend towards adult hypertension can be recognized in childhood, it may be possible to alter life style and prevent systemic hypertension as well as related complications.<sup>2</sup> NIH Task force of USA has even recommended that blood pressure measurements along with

weight and height should be recorded in children, at least once a year.<sup>3,4</sup> But even today in many parts of the world including India, this practice has not been implemented due to unknown reasons. Many studies in India have been done to know the blood pressure profile in children in varying age groups (varies from 3 to 17 years). Since there are variations in the blood pressure profile of these studies, there is need to have blood pressure profile of every region of the country. Hence the present study was taken up to determine normal blood pressure levels in apparently healthy, asymptomatic school children in the age range of 6 to 15 years in Bengaluru city and to determine the influence of contributory factors like, age, sex, body weight, height, BMI, socio-economic status and parental blood pressure status.

### Subjects and Method

It is an observational study done in randomly selected government and private school children in the age group of 6-15 years. The study sample included apparently healthy asymptomatic 1449 children. This study was done between time period from January 2015 to June 2016. In the present study, five schools, situated in Bengaluru city were selected on the basis of simple random sampling method. The schools were Government U H P B School Kumbarpet, Government Higher Primary School, Chamrajpet, Government Tamil Higher Primary School, Old Fort, Chamrajpet, Government High School, Old Fort, Chamrajpet and Tirumala Vidya Niketan, Gayatri Devi Park Extension, Vyalikaval. Study was approved and ethical clearance was obtained from ethical committee of Kempegowda Institute of Medical Sciences and Research Centre. *Inclusion Criteria*; Apparently healthy school children aged between 6 – 15 yrs of Bengaluru city. *Exclusion Criteria*; Children known to have chronic heart, renal, endocrine or hepatic disease and Those not willing for giving consent. Data was collected in a prepared proforma meeting the objective of the study. Informed consent was obtained from parents of all children before measuring blood pressure. Particulars of age, sex, family history of hypertension, history of taking any drugs, which are known to produce hypertension (like corticosteroids) and any symptom suggestive of increased blood pressure were recorded in the proforma. Age was taken in complete years and was recorded from the school registers. Assessment of socio-economic status was done in all children according to Modified Kuppuswamy's Scale. Height and weight were measured in all children by standard techniques as described by Indian Council of Medical Research and the BMI were calculated. Blood pressure was recorded using sphygmomanometer in sitting position and recorded in right arm, after applying appropriate size cuff as per guidelines suggested by NIH revised 2005. The onset of the first sound was taken as the systolic pressure (Korotkoff Phase I) and the absence of all sounds (Korotkoff Phase V) was taken as diastolic blood pressure<sup>5</sup>. Three readings were taken in succession with an interval of 5 minutes. The average of the three readings was calculated and entered in the proforma. Those children in whom blood pressure was found to be abnormal for his/her age, were reexamined on two different occasions at an interval of 1 to 2 weeks and blood pressure was recorded in lying posture also. Blood pressure values were compared in relation to age, sex, height, family history of hypertension and BMI to the values given by the revised 2005 dated The Fourth Report On The Diagnosis, Evaluation, and Treatment of High Blood Pressure in Children and Adolescents<sup>5</sup>. Children were grouped as hypertensive if BP > 95<sup>th</sup> percentile.

### Statistical Methods

Collected data was analyzed by using Python - software -2015. The sensitivity, specificity, PPV, NPV, diagnostic accuracy was determined by greater accuracy with lesser error. The statistical formula was used to modeled the diagnostic accuracy for the followings Descriptive statistics-Mean, Median and SD; 2. Univariate analysis-paired and unpaired t test and chi-square test

## RESULTS

In this study the total number of children aged between 6-15 years were 1449, the boys were 802 (55.35%) and girls were 647 (44.65%). In the present study, 1449 children were analyzed and 68 children were labeled as hypertensive giving a prevalence of 4.69%. Out of the 68 children found to be hypertensive, 37(2.55%) children were boys and 31 (2.14%) children were girls. Blood pressure was raised steadily with age in the present study. There was a spurt in the mean systolic blood pressure between 9-10 years from 96.25 mm Hg to 101.71 mm Hg and between 13-14 years from 107.73 mm Hg to 111.798 mm Hg, in boys. Similar spurt was also observed in girls, between 9-10 years from 96.25 mm Hg to 101.71 mm Hg and between 13-14 years from 104.26 mm Hg to 108.27 mm Hg. Mean systolic blood pressure was little high in boys than girls in 6,7, 8, 9,10,11, 13 and 14 years age groups, whereas in 12 and 15 years, mean systolic blood pressure was higher in girls than in boys. The difference was within 2 mm Hg at all ages except in 8,10 and 13 years group. However the difference was not statistically significant ( $p > 0.05$ ). Similarly there was no statistically significant difference in the mean diastolic pressure between the two sexes. The mean systolic pressure in boys steadily increased from 91.5 mm Hg in 18.55 $\pm$ 2.35 kg weight group to 111.8 mm Hg in 47.52 $\pm$ 9.17 kg weight group. The mean systolic blood pressure in girls increased steadily from 91.3 mm Hg in 17.55 $\pm$ 2.61 kg weight group to 111.40 mm Hg in 46.27 $\pm$ 9.15 kg weight group.

**Table 1: Mean Weight, Mean Height, Mean BMI and Mean Blood Pressure (Systolic and Diastolic) (Boys)**

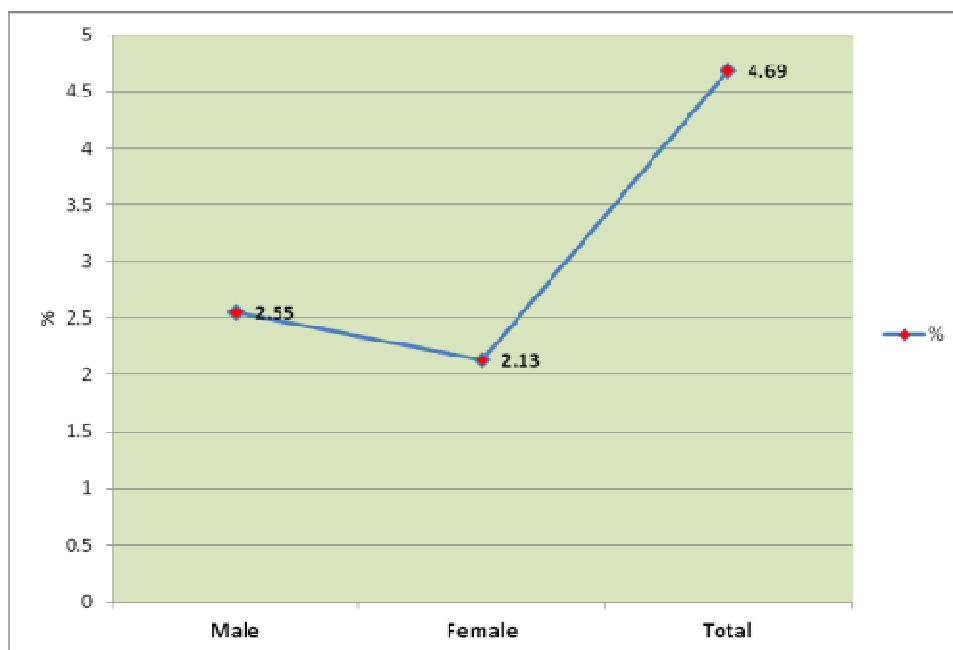
Age in Years	Mean Weight (kgs)	Mean Height (cms)	Mean BMI	Mean SBP (mm Hg)	Mean DBP (mm Hg)
6 Yrs	19.70 $\pm$ 2.05	114.58 $\pm$ 6.63	19.70 $\pm$ 2.02	93.30 $\pm$ 4.76	63.44 $\pm$ 3.83
7 Yrs	22.43 $\pm$ 2.53	118.74 $\pm$ 7.93	15.99 $\pm$ 2.02	93.72 $\pm$ 5.33	63.50 $\pm$ 4.36
8 Yrs	23.43 $\pm$ 3.19	120.80 $\pm$ 8.39	16.12 $\pm$ 1.80	95.60 $\pm$ 4.95	65.15 $\pm$ 4.62
9 Yrs	26.40 $\pm$ 3.48	128.50 $\pm$ 7.04	15.99 $\pm$ 1.74	96.25 $\pm$ 6.63	64.50 $\pm$ 6.02
10 Yrs	30.75 $\pm$ 5.02	136.42 $\pm$ 7.65	16.47 $\pm$ 2.30	101.71 $\pm$ 9.61	67.94 $\pm$ 5.32
11 Yrs	37.23 $\pm$ 6.44	141.91 $\pm$ 6.33	18.40 $\pm$ 2.59	105.16 $\pm$ 9.06	70.47 $\pm$ 5.96
12 Yrs	38.68 $\pm$ 8.02	146.09 $\pm$ 7.30	18.03 $\pm$ 3.10	107.02 $\pm$ 10.45	71.83 $\pm$ 6.13
13 Yrs	44.48 $\pm$ 8.35	146.70 $\pm$ 8.47	20.54 $\pm$ 2.78	107.73 $\pm$ 11.16	73.47 $\pm$ 5.77
14 Yrs	47.52 $\pm$ 9.17	152.22 $\pm$ 8.97	20.40 $\pm$ 2.79	111.98 $\pm$ 13.35	74.75 $\pm$ 7.68
15 Yrs	48.15 $\pm$ 10.37	157.80 $\pm$ 9.50	19.18 $\pm$ 3.09	110.99 $\pm$ 12.29	74.26 $\pm$ 7.64

**Table 2: Mean Weight, Mean Height, Mean BMI and Mean Blood Pressure (Systolic and Diastolic) (Girls)**

Age in Years	Mean Weight(kgs)	Mean Height (cms)	Mean BMI	Mean BP (mm Hg)	Mean DBP (mmHg)
6 Yrs	16.38 $\pm$ 2.68	113.85 $\pm$ 10.38	12.65 $\pm$ 1.46	92.31 $\pm$ 4.31	60.00 $\pm$ 4.76
7 Yrs	21.15 $\pm$ 3.68	114.79 $\pm$ 10.36	16.16 $\pm$ 2.45	92.45 $\pm$ 4.98	62.21 $\pm$ 4.02
8 Yrs	22.59 $\pm$ 2.58	121.14 $\pm$ 8.39	15.44 $\pm$ 1.87	94.32 $\pm$ 4.07	63.48 $\pm$ 7.58
9 Yrs	26.78 $\pm$ 4.07	127.35 $\pm$ 7.58	16.50 $\pm$ 2.10	97.18 $\pm$ 6.79	64.68 $\pm$ 8.07
10 Yrs	30.78 $\pm$ 6.82	135.62 $\pm$ 10.57	16.19 $\pm$ 2.55	101.12 $\pm$ 12.04	68.24 $\pm$ 4.28
11 Yrs	34.70 $\pm$ 5.52	136.98 $\pm$ 6.03	18.39 $\pm$ 2.21	102.27 $\pm$ 9.42	69.24 $\pm$ 5.81
12 Yrs	41.03 $\pm$ 8.53	144.80 $\pm$ 6.76	19.55 $\pm$ 3.77	107.78 $\pm$ 11.02	72.38 $\pm$ 7.50
13 Yrs	40.72 $\pm$ 6.07	143.54 $\pm$ 8.15	19.68 $\pm$ 1.71	104.26 $\pm$ 17.17	71.73 $\pm$ 7.50
14 Yrs	42.67 $\pm$ 5.46	145.04 $\pm$ 6.52	20.27 $\pm$ 2.55	108.27 $\pm$ 9.05	72.58 $\pm$ 4.71
15 Yrs	46.27 $\pm$ 9.15	149.1 $\pm$ 6.89	20.74 $\pm$ 3.28	111.40 $\pm$ 12.75	73.87 $\pm$ 7.51

**Table 3: Correlation of Blood Pressure with Weight, Height and BMI in Boys and Girls**

	Male	Female	Correlation Value	T-Value	P-Value
BMI	17.722.02	17.282.59	0.85**	12.56	0.0001
Weight	32.49 $\pm$ 4.02	30.96 $\pm$ 5.15	0.78**	36.22	0.002
Height	138.52 $\pm$ 7.25	136.22 $\pm$ 8.02	0.83	14.78	0.0002



**Figure 1: Prevalence of Hypertension in Percentage According to Sex**

The mean diastolic blood pressure in boys steadily increased from 54.29 mm Hg in 18.55±2.35 kg weight group, to 74.7 mm Hg in 47.52±9.17 kg weight group. The mean diastolic blood pressure in girls steadily increased from 59.16 mm Hg in 17.55±2.61 kg weight group, to 73.87 mm Hg in 46.27±9.15 kg weight group. The increase in mean systolic and diastolic blood pressure in both sexes was steady. In the present study there was a definite rise in the mean systolic and mean diastolic pressure in both sexes when arranged according to height groups. In boys mean systolic blood pressure increased from 91.5 mm Hg in the 114.69±4.22 cm group to 111.98 mm Hg in 152.22±8.97 cm group. In girls mean systolic blood pressure increased from 91.3 mm Hg in 113.85±7.65 cm group to 111.40 mm Hg in 149.1±6.89 cm group. The mean diastolic pressure in boys increased from 59.29 mm Hg in 114.69±4.22 cm group to 74.26 mm Hg in 152.22±8.97 cm group. In girls, the mean diastolic blood pressure increased from 59.16 mm Hg in 113.85±7.65 cm group to 73.87 mm Hg in 149.1±6.89 cm group. The correlation coefficient of blood pressure (both systolic and diastolic) with weight and blood pressure with height and BMI in both cases were calculated (Table 1- 3). It was found that there is significant positive correlation between blood pressures and weight, blood pressure and height blood pressure and BMI in both sexes ( $p < 0.05$ ). The mean systolic and mean diastolic blood pressures of children from four different socio-economic statuses were compared

It was found that the differences in the mean systolic and mean diastolic pressures in different classes were less than 2 mm Hg. Between one socio-economic status to the other, the difference in the mean blood pressure (mm Hg) was statistically not significant (NS) ( $p > 0.05$ ). The mean systolic blood pressures between the two groups (one with family history of blood pressure and the other without family history of blood pressure) were less than 2 mm Hg. However, it was found that the difference between the systolic blood pressure of the two groups and also between the diastolic blood pressure of the two groups were statistically not significant (NS) ( $p > 0.05$ ).

## DISCUSSIONS

This is an observational study done in five schools of Bengaluru city consisting 1449 school children in the age group of 6-15 years. The prevalence of hypertension in this study was 2.55% in boys and 2.14 in girls with an overall

prevalence of 4.69%. It has been shown that blood pressure, both systolic and diastolic, gradually increases with age. The findings of the present study regarding mean systolic and mean diastolic pressure are comparable with findings of the study conducted by Mohammad Sayeemuddin et al<sup>6</sup>. The gradual increase in the blood pressure along with increase in age can be explained by the fact that, the body mass also increases, which is one of the determinants of blood pressure, along with age. It has been seen that the mean systolic and mean diastolic blood pressures increase steadily and proportionately with weight in the present study. This finding is in agreement with that of Major Diva Reddy et al<sup>7</sup> and Srinivasa H A et al<sup>8</sup> who found the same in their studies. In the present study the mean systolic blood pressure and mean diastolic blood pressure were found to increase with increase in the body height in both sexes. Mohammad Sayeemuddin et al and Major Diva Reddy noted similar correlation between height and systolic and diastolic blood pressures in both sexes in their study. The mean systolic blood pressure and mean diastolic blood pressure were found to increase with increase in the Body Mass Index (BMI) in both sexes. Srinivasa et al and Major Diva Reddy noted similar correlation. It can be seen from the above findings that in majority of the students there was no significant relationship between blood pressure status and socio-economic status. Although socio-economic status is not showing any direct relationship to blood pressure status, it is possible that, it may exert its effect indirectly by affecting body weight and body mass which are the strong determinants of blood pressure. The present study shows that there was no significant association between parental hypertension and blood pressure in their children. Similar observation was made by Sachdev, who actually recorded blood pressure of both the parents and their children and compared them. Major Diva Reddy et al in their study showed that the same<sup>7</sup>. In the present study the reason for lack of significant association between parental blood pressure status and blood pressure of their children is not clear. The probabilities are that, No attempt was made to measure the blood pressure of parents whose children were labeled as hypertensive due to non cooperation from parents; hence the true state of affairs might have been missed, most children were unaware of their parental blood pressure status, parents themselves might not have undergone regular medical checkups which include routine blood pressure recordings and prevalence of hypertension in the present study (4.69%) was comparable to most of the studies conducted in India and abroad.

## CONCLUSIONS

Present study concludes that blood pressure could be associated with age and BMI. It was not significant in children with family history of hypertension and in different classes of socio economic status

## RECOMMENDATION

Large number of studies with large number of children, from various socio-economic groups, in obese children and with parental blood pressure recordings are needed and blood pressure recording should be a part of school health programme and also of clinical examination of children, attending health care system, to identify and treat hypertension early, to prevent the late complications

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